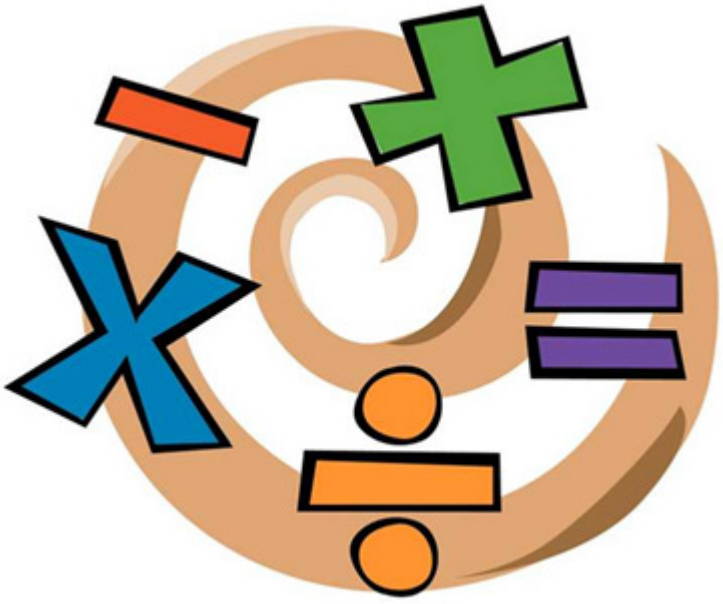
Further Applications of Area and Volume

General – HSC course



Name: _____

HSC CAPACITY MATRIX – GENERAL MATHEMATICS

TOPIC: Measurement 5 – Applications of Area and Volume 2 weeks

CONTENT	CAPACITY BREAKDOWN!	DONE IT!!!!	GOT IT!!!!!	ON MY WAY!	WORKING ON IT!	HELP!!!!
1. Calculating areas of ellipses, annuluses and parts of a circle (quadrant, sector) using appropriate formulae	Ex 2A LHS Q1-14, all of 15- 21					
2. Calculating areas of composite figures	Ex 2B LHS Q1-12, all of Q13-18					
3. Applying Simpson's rule with one application	Ex 2C LHS					
4. Surface area of a sphere	Ex 2D Q8-10, 15-19					
5. Calculating external surface area of open and closed cylinders	Ex 2D LHS Q1-7, 11-14					
6. Calculating volumes of composite solids	Ex 2E LHS					
7. Determining errors in calculations resulting from errors in measurement.	Ex 2F every odd question					

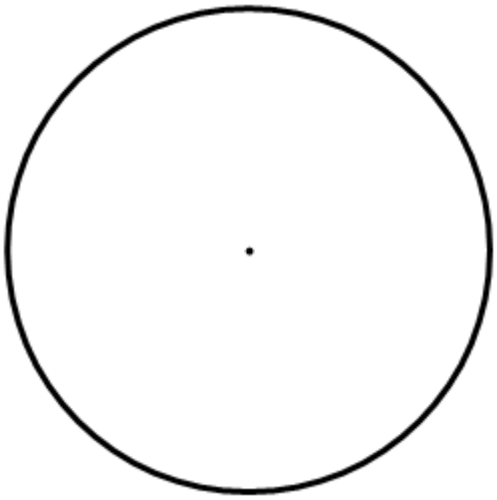
Your say!

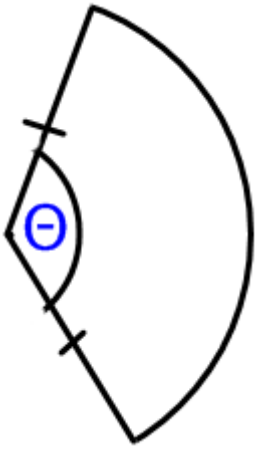
What was the most important thing you learned?_____

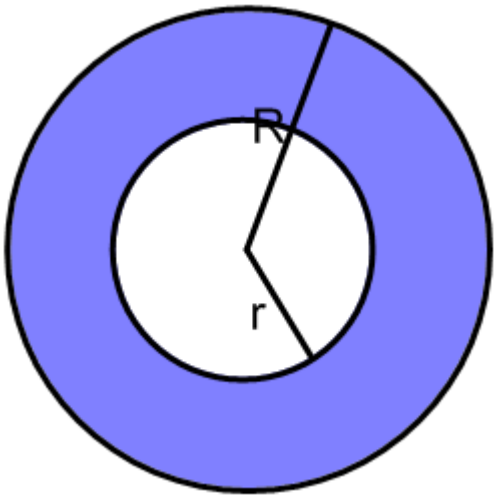
What was something new you learnt? _____

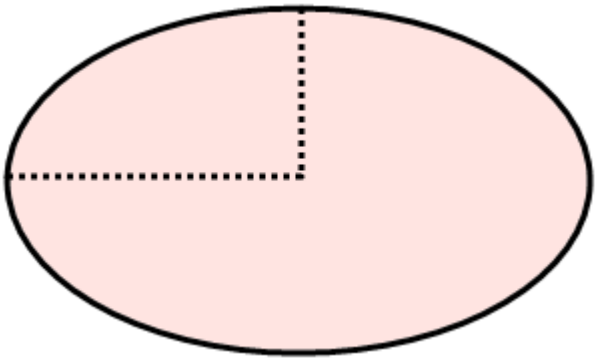
What part(s) of this topic will you need to work on? _____

Calculating the area of parts of a circle

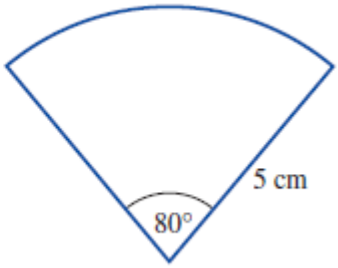




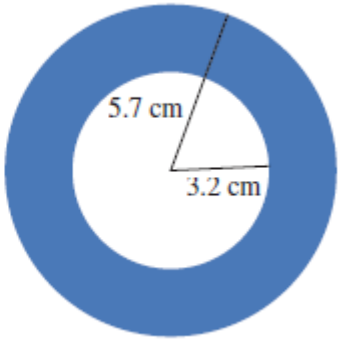




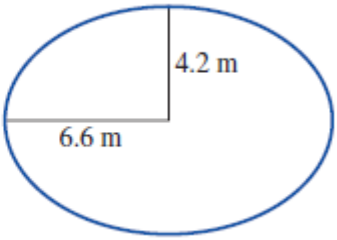
Calculate the area of the sector drawn on the right.
Give your answer correct to 1 decimal place.



Calculate the area of the annulus on the right.
Give your answer correct to 1 decimal place.



Calculate the area of the ellipse drawn on the right.
Give your answer correct to 2 decimal places.

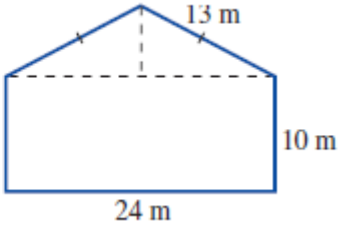


Calculating the area of composite figures

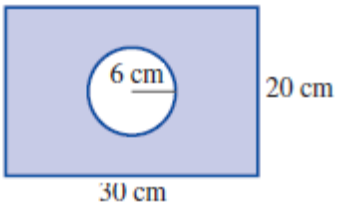
Remember...

- To find the area of any composite shape, divide into smaller regular shapes and calculate the area separately.
- Pythagoras' theorem may be useful!
- It may be simpler to calculate the area by subtracting one area from another.

Find the area of the figure on the right.



Find the shaded area in the figure on the right.

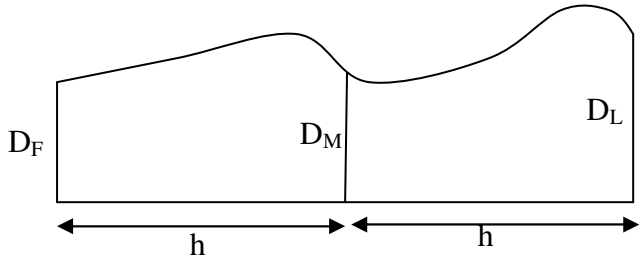


Calculating the area of irregular figures – Simpson's rule

Simpson's rule is a method used to approximate the area of an irregular figure. The formula is given to you so YOU DON'T NEED TO MEMORISE IT!

However, you do need to understand how to apply the formula.

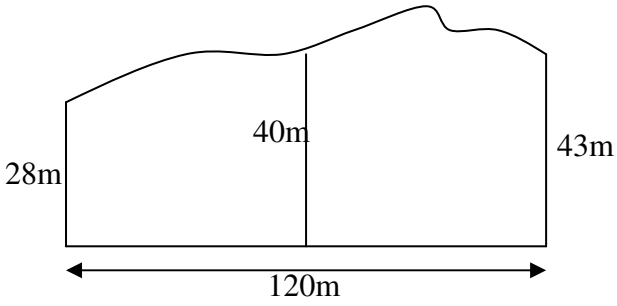
In Simpson's rule, D_F is the first measurement, D_M is the middle measurement and D_L is the last measurement. "h" is the equidistant length between each perpendicular measurement.



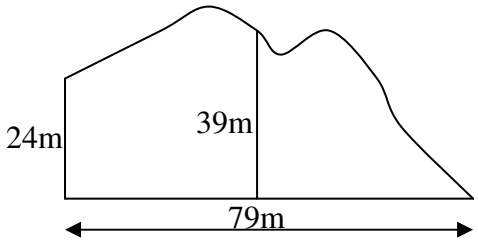
The formula is:

$$A \approx \frac{h}{3}(D_F + 4D_M + D_L)$$

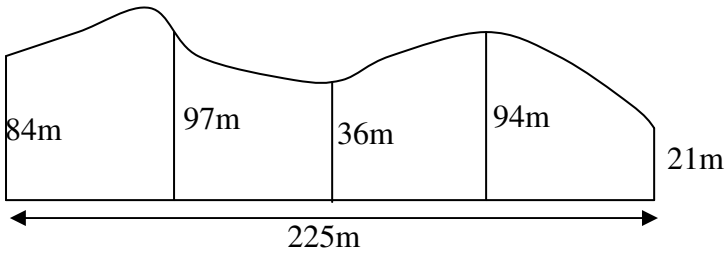
eg Apply Simpson's rule to approximate the area shown.



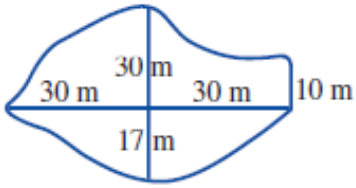
eg Use Simpson's rule to find an approximation for the area shown.



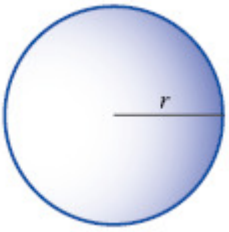
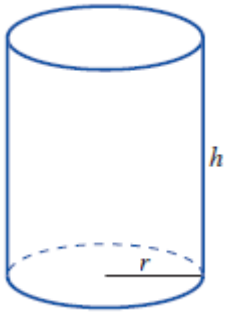
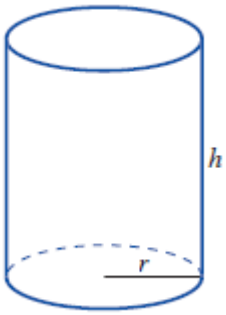
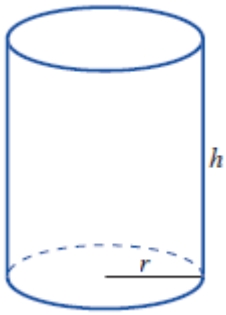
eg Use two applications of Simpson's rule to calculate the area of the field below



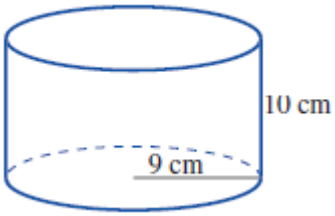
Use Simpson's rule to find an approximation for the area shown on the right.



Calculating the surface area of cylinders and spheres

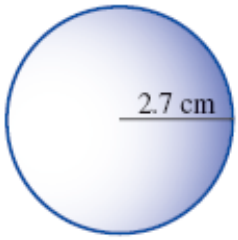
Sphere	Closed Cylinder
	
Pipe	**Open cylinder**
	

eg Calculate the surface area of the closed cylinder, to nearest cm^2.



eg A cylindrical pipe is to have the outside painted. The length of the pipe is 1.2m and the diameter is 10cm. Calculate the area to be painted to the nearest 0.1 m^2.

Calculate the surface area of the sphere drawn on the right. Give the answer correct to 1 decimal place.



Calculating the volume of composite solids

Remember...

- A PRISM is a solid in which every cross-section taken to the base shape is equal to the base shape;
- The base shape of a prism is NOT necessarily the bottom!
- V = AH; where

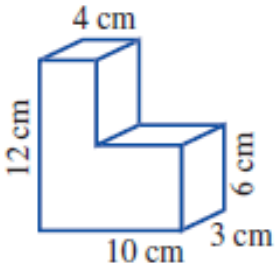
  A = area of base shape;

  H = height of the solid
- A PYRAMID is named according to its base shape and to calculate its volume : $V = \frac{1}{3}AH$
- A SPHERE is $V = \frac{4}{3}\pi r^3$
- Capacity is: $1cm^3 = 1$ ml;

  $1\ m^3 = 1000L = 1$ KL

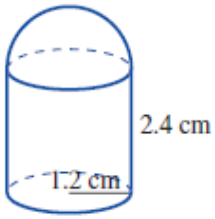
eg For the solid on the right:

a) Neatly sketch the cross-section of the solid, giving all dimensions;

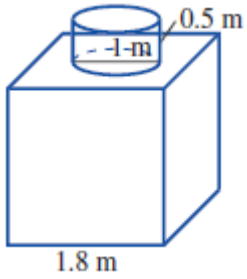


b) Calculate the volume of the solid.

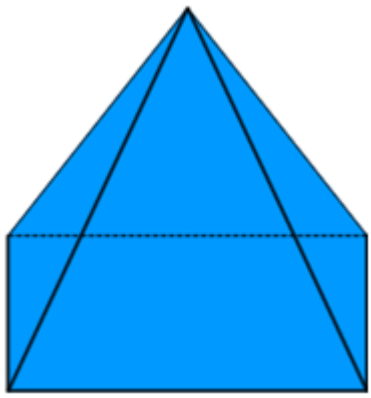
Calculate the volume of the figure drawn on the right, correct to 2 decimal places.



eg A water storage tank is in the shape of a cube of side length 1.8m, surmounted by a cylinder of diameter 1m with a height of 0.5m. Calculate the capacity of the tank, correct to the nearest 100 litres.



eg Research and find the dimensions of Cheop's Pyramid and add them to the diagram given. Hence calculate:
a) The surface area of the pyramid;
b) The volume of the pyramid.



Error in measurement

Remember...

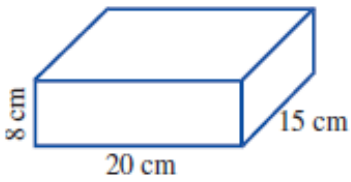
- All measurements are approximations. The accuracy of any measurement is limited by the instrument used and the most practical degree of accuracy;
- The MAXIMUM ERROR in any linear measurement is HALF the smallest unit used;
- To calculate the greatest possible error in Volume:
  1. Find the smallest possible dimensions and calculate the volume using these values;
  2. Repeat using the largest possible dimensions;
  3. The difference of your two answers is THE GREATEST POSSIBLE ERROR

eg A length of pipe has been measured as 5.43m. What is the maximum possible error of the measurement?

In the rectangular prism on the right, the length, breadth and height have been measured, correct to the nearest centimetre.

a Calculate the volume of the rectangular prism.

b Calculate the greatest possible error in the volume.



A swimming pool is built in the shape of a rectangular prism with a length of 10.2 m, a width of 7.5 m and a depth of 1.5 m. The floor and the sides of the pool need to be cemented.

Worke

a **Calculate the area that is to be cemented.**

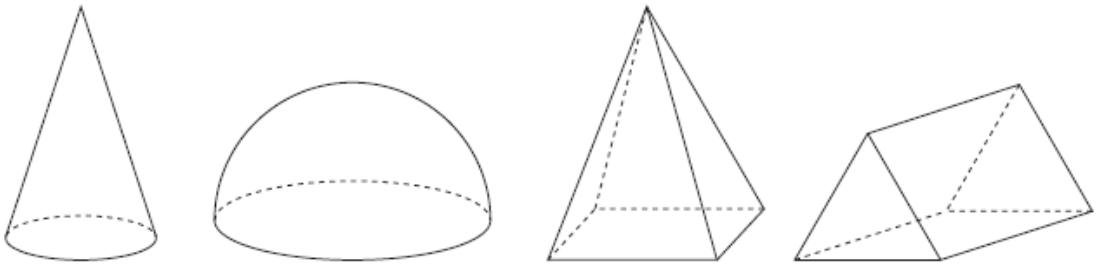
b **The concreter incorrectly measured the length of the pool as 9.4 m. Calculate the error in the area calculation.**

c **Calculate the percentage error (correct to 1 decimal place) in the area calculation.**

HSC questions

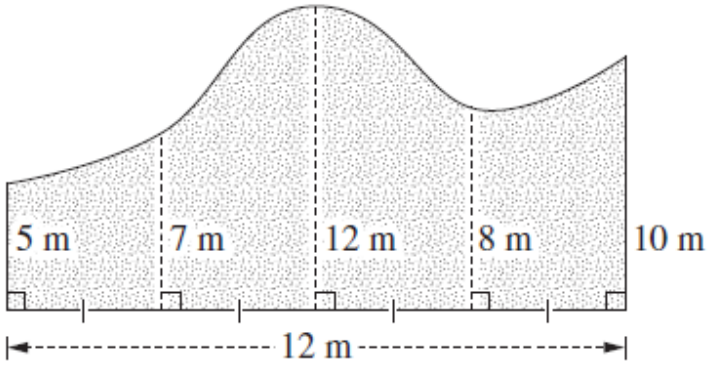
2011 HSC

1 Which of the solids shown is a prism?



(A) (B) (C) (D)

13 The diagram represents a field.



NOT TO SCALE

What is the area of the field, using two applications of Simpson's rule?

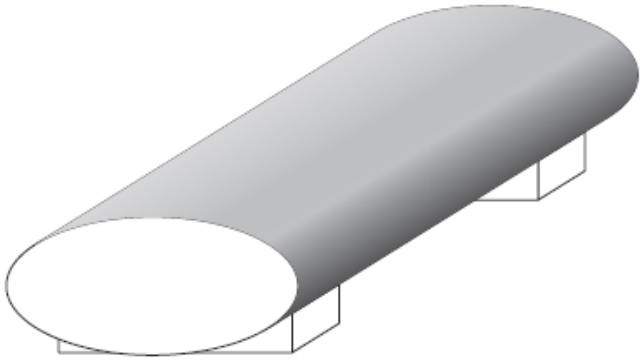
(A) 99 m^2

(B) 126 m^2

(C) 198 m^2

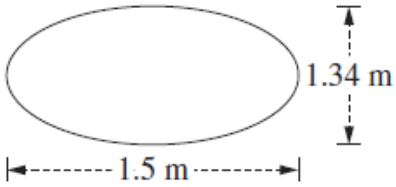
(D) 396 m^2

(d) Aviation fuel is stored in a tank. The cross-section of the tank is an ellipse.



(i) The tank holds 10 000 litres of fuel. What is the volume of the tank in cubic metres? ($1\ m^3 = 1000\ L$) **1**

(ii) The cross-section of the tank has the dimensions shown. **3**



NOT TO SCALE

What is the length of the tank? Give your answer correct to the nearest centimetre.

2010 HSC

17 During a flood 1.5 hectares of land was covered by water to a depth of 17 cm.

How many kilolitres of water covered the land? (1 hectare = 10 000 m^2)

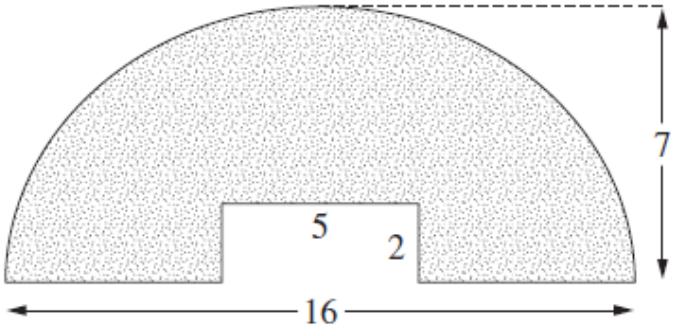
(A) 2.55 kL

(B) 2 550 kL

(C) 255 000 kL

(D) 2 550 000 kL

19 The diagram shows half an ellipse with a rectangle cut out.



NOT TO SCALE

All measurements are in centimetres.

What is the area of the shape to the nearest square centimetre?

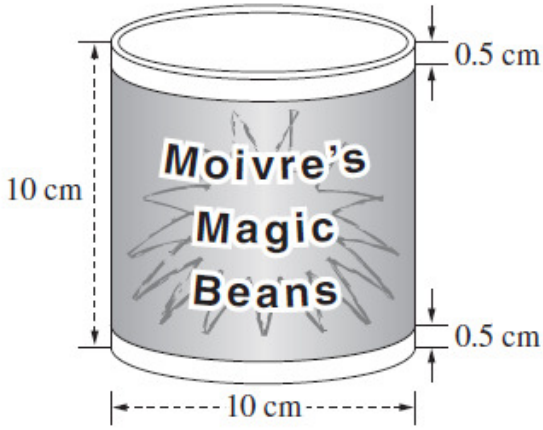
(A) 78 cm^2

(B) 83 cm^2

(C) 166 cm^2

(D) 171 cm^2

(b) Moivre's manufacturing company produces cans of Magic Beans. The can has a diameter of 10 cm and a height of 10 cm.



(i) Cans are packed in boxes that are rectangular prisms with dimensions 30 cm × 40 cm × 60 cm. **1**

What is the maximum number of cans that can be packed into one of these boxes?

(ii) The shaded label on the can shown wraps all the way around the can with no overlap. **2**

What area of paper is needed to make the labels for all the cans in this box when the box is full?

(iii) The company is considering producing larger cans. Monica says if you double the diameter of the can this will double the volume. Is Monica correct? Justify your answer with suitable calculations. **2**